第十一届化工学院国际交流月系列讲座

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Huanting Wang is a Professor and an ARC Australian Laureate Fellow in the Department of Chemical Engineering, the Director of the Monash Centre for Membrane Innovation at Monash University in Australia. His research focuses on nanoporous materials and composite membranes for gas separation, water desalination and purification, chiral separation, ion transport and separation, and electrochemical energy applications. Professor Wang has published over 350 journal papers and is an inventor of eight patents licensed for commercial development. He has received many awards including IChemE Underwood (2021), RACI R.K. Murphy Medal (2019) and MSA Tony Fane Award (2020). He is a Fellow of RSC, AIChE and The Australian Academy of Technology and Engineering.

Lecture 17. July 8th 13:30 pm-15:30 pm, Room6105 - Building 10
腾讯会议, ID:724 758 416

Sub-1nm porous membranes for molecular and ionic separation

Sub-1nm porous materials such as metal–organic frameworks (MOF) have shown great potential for energy-efficient gas separation and ion separation. Ultrathin and defect-free MOF membranes are required to achieve high flux and thus reduce process costs. We have developed new seeding strategies for fabricating ultrathin and high-quality molecular sieving membranes on various porous substrates. For instance, hybrid MOF nanosheets are formed by growing MOF nanocrystals on both sides of 2D graphene oxide nanosheets. These flexible, micro-sized hybrid nanosheets allow for seeding substrates with large-pores and rough surface, eliminating substrate modification required in the conventional synthesis using nanocrystal seeds. We have found that such molecular sieving membranes and other MOF nanochannel membrane have fast, selective ion permeation properties. In addition, sub-1nm porous carbon membranes are highly attractive for molecular sieving applications such as gas separation and organic solvent nanofiltration, but they usually show low flux in liquid separation processes. We have demonstrated the fabrication of ultrathin microporous membranes with tailored porous structures on a porous ceramic substrate and subsequent carbonization. The resulting membranes exhibit water evaporation flux of 49.8 - 472.3 L m^{-2} h^{-1} and complete salt rejection at 20 - 70 ˚C. The water flux is much higher than that of conventional microporous membranes. The membranes also show high organic solvent flux and selectivity, and fast water removal from ethanol. The membrane fabrication is demonstrated to be highly reproducible and scalable, and membranes show great potential for applications such as water processing and bioethanol concentration.

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